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(दूसरा पुनरीक्षण)

Deep Freezers — Specification

(Second Revision)

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Refrigeration and Air Conditioning Sectional Committee, MED 03

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Refrigeration and Air Conditioning Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1975 and subsequently revised in 2018.

This revision has been contemplated in order rectify and/or modify some of the definitions, test procedure, test conditions and figures etc. based on the feedback and inputs received from various stakeholders.

This standard specifies safety, constructional and performance requirements of deep freezers. This standard is limited to the freezers working on the vapour compression refrigeration system using natural or forced draught air-cooled condenser.

The composition of the Committee, responsible for the formulation of this standard is given at Annex F.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard
DEEP FREEZERS — SPECIFICATION
(Second Revision)

1 SCOPE

1.1 This standard specifies the safety, constructional and performance requirements including methods of determining performance of deep freezers based on vapour compression working principle. This standard covers deep freezers of top access type, having a storage volume up to and including 1 000 litre, with both hard top, glass top (sliding, hinged and curved) and their rated voltage not exceeding 240 V a.c. 50 Hz for single phase and 415 V a.c. 50 Hz for three phase a.c. including units with fixed speed and variable speed compressors.

1.2 The following types of deep freezers are not within the scope of this standard:

a) Vertical freezer;
b) Combo freezers (freezer+ cooler); and
c) PCM/Eutectic based freezers/ Blast freezers.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All the standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Food Freezer — A thermally insulated cabinet which is intended for storing of frozen food for storage application when the food is brought in at same or lower average temperature than -18°C.

3.2 Ambient Temperature — The measured temperature in the space surrounding the deep freezer under test. It is the arithmetical average value of temperatures measured at three points, located at 350 mm from the vertical centreline of the two opposite side walls and front side of the deep freezer (*see* Annex B).

3.3 Balanced Pressure — It is the pressure in the ‘off’ cycle at any point in the refrigeration system after the high and low sides have attained a condition of thermal equilibrium at design ambient condition.

3.4 The Average Freezer Air Temperature — The average inside air temperature taken by means of thermocouples or thermometers located at places in the freezer cabinet (*see* Fig. 9 and 10 of Annex C)

3.5 Cycles per 24 Hours — A cycle in the operation of a freezer is the period during which a compressor goes through the steps of starting, running, stopping and starting again. Cycles per day can be determined by dividing the number of complete cycles by the elapsed time in hours and multiplying the result by 24.

3.6 Percentage Running Time — The percentage running time, under required conditions of ambient temperature and of average internal temperature, is the ratio of duration of compressor operation during a full number of cycles to the total duration of full number of cycles as represented by the following equation:

$$R = d / D \times 100$$

where

d = duration of compressor operation during a full number of cycles, and
D = total duration of full number of cycles

NOTE — *See* Fig. 9 for thermocouple position under no load conditions

3.7 Overall Dimensions (Door or Lids Closed) — Measurement of the outside rectangular dimensions over the horizontal base within which the freezer inscribed to include the complete appliance shall also include the protrusion of the handle. The dimensions of all external accessories other than handle provided/ recommended by manufacturers shall be specified separately.

3.8 Overall Space Required for Use (Doors or Lids Open) — Overall dimensions including the handle, space necessary for free circulation of the cooling air when the appliance is in service, plus the space necessary to allow door opening up to minimum angle permitting removal of all removable parts such as containers and shelves, etc.

3.9 Gross Volume — Total volume contained within interior walls of the freezer without internal fittings namely, baskets, partition self and similar fittings with the door closed as determined by the method described in **8.2**.

3.10 Rated Gross Volume — Gross volume declared by the manufacturer as determined by the method described in **8.2**.

3.11 Storage Volume — The total volume contained within interior walls of the freezer for storage of food, which remains after deduction of the volume of components and spaces recognized as unusable for the storage of food (considering maximum storage limit line).

3.12 Rated Storage Volume — Storage volume declared by the manufacturer.

3.13 Maximum Storage Limits Line — The line which defines maximum line up to which the storage can be done as per manufacturer instruction.

3.14 Front Access Type — Appliance in which the storage compartment(s) is (are) accessible from the front as shown in Fig. 1.

3.15 Top Access Type — Appliance in which the storage compartment(s) is (are) accessible from the top as shown in Fig. 2.

3.16 Storage Basket — A basket is any combination of vertical and/or horizontal surface (shelves, partitions, etc.) in which food can be placed. It may be formed by one component or by components fitted side-by-side, which may be fixed or removable.

3.17 Storage Partitions — A partition is any combination of vertical and/or horizontal surface (shelves etc.) by which food can be separated from each other. It may be formed by wire self-partition or by components fitted side-by-side, which may be fixed or removable.

3.18 Pull-Down — It is the capability of deep freezers to achieve the average freezers air temperatures up to -18°C from an ambient temperature of 43°C at no load.

3.19 Pressure (Refrigeration System Components Except Compressor)

3.19.1 *Design Pressure* — Pressure chosen for the strength calculation of each refrigerant containing component.

NOTE — It is used for determining the necessary materials, thickness, and construction for components with regard to their ability to withstand pressure.

3.19.2 *Tightness Test Pressure* — Pressure that is applied to test a system or any part of it for tightness under pressure

3.19.3 *Maximum Allowable Pressure* (PS) — Maximum pressure which system or component is designed, as specified by the manufacturer [*see also* IS 16678 (Part 2)/ISO 5149 - 2].

3.19.4 *Refrigerating Strength Pressure* — Pressure that is applied to test the strength of a refrigerating system or any part of it.

3.20 Ambient Class — Manufacturer should mention the climate class of the product as per Table 1. In case of class other than mentioned below, manufacturer

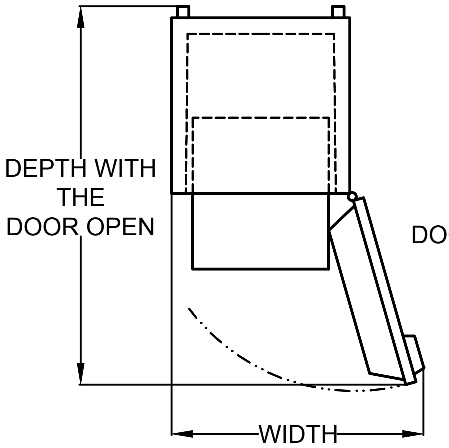


FIG. 1 FOR FRONT LOADING

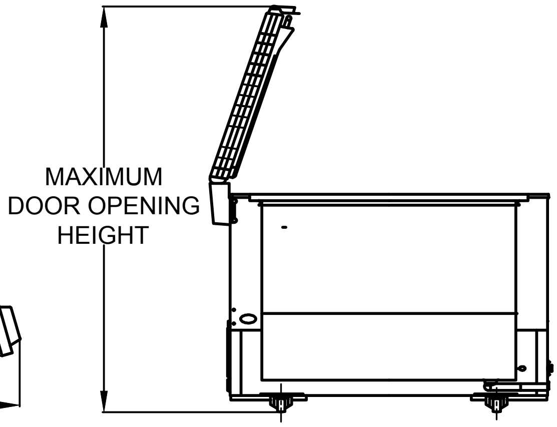


FIG. 2 FOR TOP LOADING

NOTE — The definition and the figure for front access type is given only to distinguish between the two types of opening.

must take adequate measure to communicate the effective temperature class to the customer through declaration in the user manuals/stickers or any other suitable means.

Table 1 Climate Classes

(*Clause* 3.20)

Sl No.	Description	Class	Ambient Temperature Range (°C)
(1)	(2)	(3)	(4)
i)	Extended temperate	SN	+10 to +32
ii)	Temperate	N	+16 to +32
iii)	Subtropical	ST	+18 to +38
iv)	Tropical	T	+18 to +43

3.21 Stable Operating Conditions — It is a condition when the refrigerating appliance has been left running for a minimum time according to the manufacturer's instruction without any adjustment of temperature control setting(s) during this time, and when the average M packages (with load conditions) temperatures or average air temperature (no load condition) shows changes within ± 0.5°C.

3.22 Operating Cycle — For refrigerating appliance systems designed to operate continuously, the operating cycle is defined as a period of 24 h under stable operating conditions.

For other refrigerating appliances the operating cycle is the period between two successive stops of the refrigerating system, or a part of a system, under stable operating conditions.

If a single operating cycle is longer than 48 h the values of storage temperatures and energy consumption from the first 24 h are to be compared.

3.23 Energy Consumption — Energy used by the deep freezer over a specified period of time or for a specified operation as determined in accordance with this standard stated, in kWh (kilowatt hour).

4 CONSTRUCTION

4.1 General Design

The freezers shall have adequate mechanical strength and be constructed to withstand handling and transportation that may be expected in normal use. Where an internal light is fitted, the lamp shall be suitably protected from mechanical damage but shall be accessible easily without any undue force or pressure. There shall be no sharp edges or corners liable to cause injury to the user in the normal conditions of use.

4.2 Materials

Materials used in the construction of the outer body shall comply with relevant Indian Standards wherever applicable, except where such requirements are modified by this standard. They shall be free from defects which are liable to cause undue deterioration or failure. Under normal conditions of use, the materials used shall not shrink, warp or cause odour and shall be resistant to attack by local vermin's and destructive pests.

Where liable to be exposed to moisture, chemically active substances and food or food products, they shall be suitably resistant and shall not contaminate stored products placed in contact with them. Sealing materials used shall not loose in service, any of their essential properties, such as adhesiveness, plasticity and moisture resistance, due to ageing, temperature and humidity variations.

4.3 Finish

The interior and exterior finish shall be durable and capable of being cleaned effectively and hygienically without undue deterioration. All metal parts used inside or outside the freezer which are exposed to moisture or ambient conditions shall be corrosion resistant or adequately protected against corrosion. It shall be tested for 72 h as per IS 9000 (Part 11).

4.4 Thermal Insulation

The quality, thickness and application of the insulating material shall be such that insulation of the cabinet is effective and efficient to maintain the required temperature inside the cabinet. There shall be proper seals against moisture penetration by diffusion or condensation. Detachable plates and covers in the cabinet shall be provided with suitable seals to prevent ingress of moisture into the insulation. Highly conductive external or internal surfaces shall be separated by insulating breaker strips or their equivalent. As far as possible, no member of the frame shall penetrate the full thickness of the insulation.

NOTE — Insulation material used should comply with Indian regulatory norm listed by Ministry of Environment, Forest and Climate Change for Ozone depleting substance.

4.5 Fittings

Linings and facing shall have sufficient mechanical strength to resist distortion and give reasonable protection to the insulation. When the doors of the refrigerated space are closed, there shall be no leakage of external air into the cabinet either past the door gaskets or by any other means (*see* **11.4**).

4.6 Hardware

Door fasteners and hinges shall be smooth and positive in action and designed to maintain their proper function without undue wear under normal conditions of service. Screws and all other hardware shall be adequately protected from corrosion so that they can be easily serviceable.

4.7 Interior Fittings

The rails, shelves and baskets shall be sufficiently strong for the duty specified in **11.5**. The shelves shall be of welded metallic construction galvanized, chromium plated or of non-corrosive finished casting, plastic or any other protective coating not reacting with food in any way. The shelf supports shall be strong enough to take the load. The interior lining shall be of suitable metallic sheets or polystyrene materials and shall be non-corrosive. The surfaces which are coming in contact food stuff shall be made of food grade material so that during storage it shall not impact/ deteriorate the food quality.

4.8 Doors and Fittings

Hinges and handles shall be strong and resistant to corrosion. They shall be able to withstand the normal usage without adversely affecting the air tightness of the freezer. The opening of the door shall be sufficient to enable removable shelves or baskets to be easily withdrawn. In case of horizontal freezers, the door hinges shall be spring loaded for easy closing and opening and for self-opening when the door latch is released.

Door/lid shall withstand 100 000 opening and closing without deterioration for hard top and curved glass door/lid and 50 000 opening and closing for each of the sliding doors, which in particular, may adversely affect air tightness of the freezer, when subjected to the durability test of **4.8.1**.

4.8.1 *External Doors*

a) *Procedure* — The ambient temperature during the test shall be at normal ambient and the appliance shall be switched off. The door opening and closing sequence is shown in Fig. 3.

b) *Opening sequence* — The movement of the door shall be controlled from an angle of 0° to an opening angle of 60° followed by free movement of the door.

c) *Closing sequence* — The movement of the door shall be controlled from the angle of opening of 60° to an angle between 60° and 50°, followed by the free movement of the door and its closing as in normal use. The number of cycles per minute shall be 10 to 15 as shown in Fig. 3.

NOTE — Safety standards mandate that appliances with any space large enough for a child to get into must be able to be opened from the inside provided door is in unlocked conditions.

In addition to it there should be no finger pinching during door opening.

4.9 Disposal of Defrost / Condensate Water

A means shall be provided for draining the defrost/ condensate water or while cleaning with an external receptacle. Any drainage system shall be designed to ensure its proper function. It shall be easily accessible for the clearing of any blockage, and shall be designed so as to prevent any undue ingress of air into the food storage compartment(s).

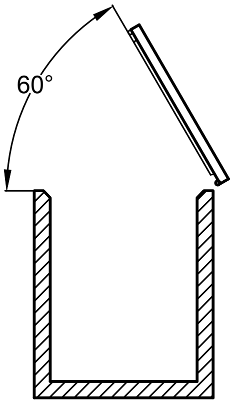


FIG. 3 DOOR OPENING SEQUENCE FOR HARD TOP AND HINGE GLASS TOP

5 REFRIGERATION SYSTEM

5.1 Construction

The pipes and connections to moving or resiliently mounted parts shall be arranged so as not to foul or transmit vibration to other parts. The pipes and connections shall be securely fixed and should be of sufficient length to minimize the risk of failure due to vibration. The evaporator may be of suitably copper coated or plated steel, copper, brass or aluminium. Stainless steel may also be used for this purpose.

5.2 Control of Operation

Refrigerant flow and compressor motor shall be controlled with the help of thermostat to maintain the cabinet temperature within the limits of application. Suitable capacity strainer or dehydrator shall be provided in the refrigeration circuit for smooth functioning of refrigeration cycle in presence of contaminations.

5.3 Location of Components

The evaporator, screens and shelves shall not obstruct access to the stored products. All control devices and service valves shall be readily accessible.

5.4 Strength-Pressure Test for Components

5.4.1 *General*

Components of refrigerating systems shall be designed with a sufficient mechanical strength. Compliance is checked by carrying out the tests specified in **5.4.2** to **5.4.4**.

5.4.2 *Individual Strength-Pressure Test*

Each component shall be strength-pressure-tested individually at minimum 1.43 × PS for a period of minimum 1 min. The individual strength-pressure test shall be carried out as a hydrostatic pressure test by means of water or some other liquid, except where a component cannot be pressure-tested with liquid for technical reasons. In that case, it shall be tested by means of air or some other non-hazardous gas. Adequate precautions shall be taken to prevent danger to people and to minimize risk to property.

5.4.3 *Type-Approved Strength-Pressure Test*

As an alternative, the components can be type-approved by testing at 3 × PS or by testing according to the fatigue test as described below. If the maximum continuous operating temperature exceeds 125°C for copper or aluminium, or 200°C for steel, then the type-approved strength test pressure shall be increased according to the ratio of allowable stress at the test temperature and that at the maximum continuous operating temperature based on a known pressure vessel code or a published national or international standard. For example, if the material of the component has an allowable stress of 35 N/mm^2 at test temperature and 27 N/mm^2 at maximum continuous operating pressure, then the type-approved test shall be conducted at 3 times (3 × 35/27) of maximum allowable pressure.

5.4.4 *Fatigue Test*

As an alternative to the pressure test as mentioned above, the components shall be subjected to a strength-pressure test at 2 × PS provided they comply with the fatigue test as described below.

Three test samples shall be filled with fluid and shall be connected to a pressure-driving source. The pressure shall be raised and lowered between the upper and lower cyclic values at a rate specified by the manufacturer for a total number of 250 000 cycles. The entire specified pressure excursion shall occur during each cycle.

NOTES — For safety purposes, it is suggested to use a non-compressible fluid. The following test pressures shall be applied. For the first cycle, the maximum PS for the low-pressure side components or the maximum PS for the high-pressure side components shall be applied:

a) For the test cycles, the upper-pressure value shall not be less than 0.7 × PS and the lower-pressure value shall not be greater than 0.2 × PS. The pressure shall be 0.9 × PS for water heat exchangers in the heat pump.
b) For the final test cycle, the test pressure shall be increased to 1.4 × PS (two times of 0.7 × PS). The pressure shall be 1.8 × PS (two times of 0.9 × PS) for water heat exchangers in the heat pump.

5.4.5 *Acceptance Criteria*

In the case of individual strength test at minimum 1.43 × PS, permanent deformation shall not result from these tests. In the case of type approval, it is deemed that the components are designed to withstand a pressure not less than three times the component's maximum allowable pressure without rupture (or not less than two times the component's maximum allowable pressure without rupture after the fatigue test) and confirmation shall be provided by testing. In the case of the fatigue test, the component shall not rupture, burst, or leak after completion of this test. The strength-pressure test at 2 × PS is to be performed on three samples, other than the samples used for the fatigue test. If the maximum continuous operating temperature exceeds 125°C for copper or aluminium, or 200°C for steel, the fatigue test shall be conducted at least 10°C above the maximum operating temperature.

PS is the maximum allowable pressure, for each component shall not be less than the maximum allowable pressure of the system or part of the system.

6 SAFETY REQUIREMENTS

6.1 General

The deep freezers shall comply with the safety requirements given in *clause* **8** to **32** of IS/IEC 60335-2-89. The equipment shall be capable of working within ± 10 percent of rated voltage specified in **1.1**.

6.2 Hermetically Sealed Compressor

The compressor shall comply with the requirements of IS 10617 and shall be so constructed that the constant pressure of oil and refrigerant under working pressure and temperature has no adverse action of the compressor motor's insulation material and windings.

6.3 Protective Guards

All moving parts shall be protected by suitable guards, shields or screens of adequate strength and durability to avoid the possibility of making inadvertent contact therewith during normal service conditions.

6.4 Electrical Accessories

All internal electrical fittings, such as lamps, and switches, shall be provided with suitable guards for protection against mechanical damage and shall be suitable for operation at the lowest air temperature likely to occur.

6.5 Flammable Refrigerant

For flammable refrigerant the units should comply with IS/IEC 60335-2-89.

7 SOUND PRESSURE LEVEL

The refrigerating system shall not have sound pressure level more than 65 dBA for commercial places (Ambient Air Quality Standards in respect of noise as per *Noise Pollution (Regulation and Control) Rules,* 2000 issued by Ministry of Environment, Forest and Climate Change) the normal running operation at no load at prevailing room temperature and should not transmit vibration to adjoining portions of the surroundings.

A random machine should be picked from manufacturing line for conducting the sound test. Freezer should be placed centrally in the test chamber with background noise less than 45 dBA.

With the help of calibrated sound meter/analyser or recorder, noise level of freezer is to be measured at a distance of 1.1 m from each side (except back side) of freezer and 1.2 m above the floor.

8 MEASUREMENT OF FREEZER STORAGE CAPACITY

8.1 Inside Dimensions of the Cabinet

Place cross-section area with maximum storage limit line and mark L × W × H (*see* Annex C and E). Maximum load limit line should be marked clearly.

8.1.1 *Top Access Type*

8.1.1.1 *Inside depth*

This shall be the mean horizontal distance between the front and rear inner surfaces of the front and back walls of the enclosed space of the cabinet.

8.1.1.2 *Inside width*

This shall be the mean horizontal distance between the inner surfaces of the side walls of the enclosed space.

8.1.1.3 *Inside height*

This shall be the mean vertical distance between the inner surface of the floor and the lid or door.

8.2 Gross Volume

The gross volume of the freezer shall be the product of inside depth, inside width and inside height as defined in **8.1.1**.

In case of intricate shapes of the liners, the total volume shall be divided into convenient units of volume of geometric shape. Volume of all such units shall be calculated from their mean inside dimensions and added to yield gross volume. Shapes formed in the wall of the food compartment and in the door (bulges, hollows, etc) are taken into account in calculating the gross volume. When the freezer is divided into compartments by fixed insulated partition, each compartment shall be regarded as a separate freezer for the purpose of computing volume and the sum of each of such volume shall be gross volume.

8.3 Storage Volume (Net Volume)

The storage volume shall be the gross volume or sum of the gross volumes of individual compartments less the volumes of internal fittings fixed in the cabinet and the volumes of the shelves, partitions and baskets essential which are assembled with tools for the proper operation of the cabinet. This volume will be obtained after deducting from the gross and also deducting the volume of any other space which is identified as unusable for storage of food, provided that its individual volume is greater than 0.25 litre or its thickness or width is greater than 13 mm:

a) Volume occupied by parts necessary for proper functioning of the freezer, such as evaporator material, evaporator doors, cooling coils, evaporator ribs and suction header;

b) Volume between the deductible door projections and adjacent liner walls;

c) Volume occupied by fixed partitions or projections, such as control knobs, shelf hangers, shelf and tray rails or basket supports which individually occupy a volume of more than 0.25 litre and have a width or thickness of more than 13 mm; and

d) The load line (*H*) as shown in Fig. 12 and for volume measurement Fig. 9 and Fig. 10 of, shall be specified by the manufacturer.

8.4 Volume of Shelves Partitions and Internal Fittings

The volume of a shelf, partition or internal fitting (excluding baskets) shall be the product of its area and thickness. The area of a shelf shall be the product of its width and depth. Where part of the shelf is cut away, the area of the cut-out shelf shall be deducted. Where the edge of the shelf is not more than 25 mm from the cabinet lining, the shelf shall be considered as extending to the lining for the purpose of calculating shelf area. Where there is an access door in a wall of the cabinet, the inner surface of the door shall be considered as being the inner surface of the lining.

The thickness of the shelves and partitions shall be the distance between the outer surface excluding the edges, where those are reinforced (*see* Fig. 4). Where surfaces are corrugated or fitted with pipe grids, the plane through the apices of the corrugations or pipes shall be used for calculating volumes except that where the clear distance between adjacent corrugations or pipes is greater than 100 mm, the surface itself shall be used and a volume shall be deducted for each corrugation or pipe equal to the product of the width, the distance from the surface to the outside of the corrugation or pipe and the length of the corrugation of pipe.

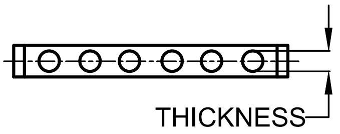


FIG. 4 THICKNESS OF SHELVES

8.5 Volume of Baskets

The volume of baskets to be deducted from the gross internal volume in the determination of storage volume shall include the space not available for storage at each side and end of the basket and the volume of the bottom of the basket (*see* Fig. 5). If basket is plug and play type means it does not require specified tool to assemble in product, then its volume should not be deducted for storage volume calculation.

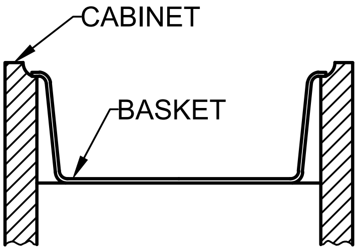


FIG. 5 DEDUCTION OF VOLUME FOR BASKET

8.6 Full Partition

The volume of a full partition is the product of its thickness, depth and width or height. This depth, width and height are those dimensions of the cabinet applicable in the plane of partition.

8.7 Fractional Partitions

The volume of a permanently fixed fractional partitions is the product of its thickness, depth and width or height, whichever of these two is applicable. The depth, width or heights are the distances normal to the lining from adjacent surfaces to the further edges of the partitions or to the evaporator in case the fractional partition touches it. A horizontal partition the edges of which are more than 70 mm from the lining of the cabinet is regarded as fractional partition. A vertical partition, the edges of which are more than 100 mm from the lining of the cabinet, is regarded as a fractional partition.

8.8 Suspended Containers

The area of the bottom of a suspended container and the area of the shelf beneath shall not both be counted unless the vertical clearance between this shelf and the bottom is at least 100 mm. If the mean depth vertically of a suspended container as measured between its bottom and the cover or shelf immediately above is less than 40 mm the bottom area of the container shall not be considered

8.9 Rated Gross Volume

This shall be the gross volume as declared by the manufacturer, in litres. The measured gross volume as described in **8.2** shall not be less than the rated gross volume by more than 3 percent.

8.10 Rated Storage Volume

This shall be the storage volume as declared by the manufacturer, in litres. The measured storage (net) volume as described in **8.3** shall not be less than the rated storage volume by more than 3 percent.

9 GENERAL TEST CONDITIONS

9.1 Freezer Installation

Unless otherwise specified, the test shall be made on the freezer installed as for normal use with shelves, baskets and other fittings, if any, in their normal positions in accordance with the manufacturer's instructions, with all containers being empty.

9.2 Electrical Power Supply

For the test during which the freezer will be in operation, electric power supply shall not vary by more than ±1 percent of the rated voltage and frequency.

9.3 Rated voltage for single phase and three phase shall be as specified in **1.1**.

9.4 Test Room Ambient

The test room shall be capable of being maintained up to maximum of temperature class declared with ± 1°C.

For temperature class of 16°C to 43°C, the chamber should be able to maintain 43 ± 1°C. The vertical ambient temperature gradient from the platform as specified to a height of 2.1 m shall be within 1°C for each 1 m of vertical distance.

9.5 The freezer shall be placed on a solid top platform the way it should be installed under normal use. The freezer shall be so placed or shielded as to prevent direct radiation from the test room heating equipment. Circulation of air around the appliance shall be restricted by surrounding the appliance by three vertical partitions, fixed or adjustable, made of wood 16 to 30 mm thick, arranged as follows:

One of the partitions shall be placed parallel to the rear of the appliance, against the stops/ hinges or 100 mm or at the distance specified by the manufacturer in connection with the required overall space.

The two other partitions shall be parallel to the sides of the cabinet and shall be fixed on the platform 350 mm from the sides of the cabinet.

The appliance shall be so placed or shielded as to prevent direct radiation to or from the space cooling or heating equipment in the test room, and shall be placed far enough away from all other objects in the test room to eliminate any possibility of any point in the space in which it is situated being at a temperature other than ambient. Air circulation in the test room shall-be such that the specified ambient temperatures are obtained within the limits of the specified tolerances.

The appliance under test shall be shielded from any air currents of velocity above 0.25 m/s. The air circulation in the test room shall not interfere with the normal air circulation created by the appliance.

9.6 General Operating Conditions

Prior to the start of first tests, the unit should be defrosted and the interior of the cabinet dried. Units should be switched on after all the internal parts have achieved the ambient temperature of the test after a minimum soaking period of 4 h. The freezer shall then be allowed to operate at the ambient temperature of the test for at least 4 h to establish the thermal equilibrium. Stable operating conditions are deemed to be reached when during a time of 2 h the mean temperatures measured at the same position of the control cycle do not vary by more than 0.5˚C from the final regulated figure.

9.7 Humidity

Unless otherwise specified, relative humidity of the test room shall be kept between 45 percent and 75 percent.

10 MEASUREMENT

10.1 Measuring Instruments

10.1.1 Watt-hour meters shall be capable of being read to 0.001 kWh and be accurate to within ± 1 percent of the total energy consumption measured during the test period, which is 1 percent of the reading.

10.1.2 The temperatures shall be measured with thermocouples, or other temperature measuring probes, which are inserted in the centre of a copper mass weighing 25 g and of minimum external area (diameter and height = about 15.2 mm).

10.1.3 Relative humidity shall be measured either by means of ventilated psychrometers having thermometers of an accuracy of ± 3 percent or with recording apparatus of equivalent accuracy. When psychrometers are used, it shall be necessary to carry out measurement at regular intervals.

10.2 Temperature Measurement Conditions

10.2.1 *Ambient Temperature*

Ambient temperature shall be maintained within ± 1°C of the specified value and shall be measured at 300 mm from the sides and front of the cabinet and at the height of the geometric centre of the front and sides. This condition shall be maintained during both stabilization and test period.

The ambient temperature shall be recorded at one of the above positions preferably with a recording instrument. If an indicating instrument is used, reading shall be taken at intervals not greater than 30 min. Temperatures may be read or preferably recorded. The temperature sensitive element of the temperature measuring instrument shall be separated from any heat conducting surface by at least 13 mm of air space. Connections from the measuring instruments shall be arranged in such a manner as not to interfere with the air-seal of the storage compartment.

All instruments used for measuring shall be calibrated against master instruments of certified accuracy.

Temperature measuring instruments shall have an accuracy up to 0.5°C.

11 TESTS

11.1 No Load Pull Down Test

The freezer shall be operated under no load, at 43°C ambient as per climate class T**.** The time required to pull down the average freezer air temperature from maximum temperature of 43°C to an average temperature of -18°C and maximum temperature shall not be warmer than -15°C and pull down time shall be not more than 200 min. The position of the thermocouple shall be as given in Fig. 9. The temperature shall be stabilized before the test within 43 ± 1°C.

11.2 Energy Consumption Test

The freezer shall be operated at no load in an ambient temperature of 38°C for at least for 4 h prior to commencement of the testing.

After stable operating conditions (no load) have been attained the test period shall start. It shall be operated for 6 hrs and calculated for 24 h duration. During this period the average temperature should be below -18^{o}C.

The energy consumption shall be determined either by one test at the target temperatures or by interpolation from the results of two tests when target temperature is not achieved by one test. When interpolation is used, the temperature obtained from one of the two tests shall be warmer than the target temperature, and the temperature obtained from the other of the two tests shall be colder than the target temperature. The difference between the two temperatures used for the interpolating test shall not exceed 4°C.

The calculated energy consumption rate E_x is given by the equation (*see* IS 15750):

$$E_X = E_1 + \left[\left(E_2 - E_1 \right) \times \frac{\left(t_X - t_1 \right)}{\left(t_2 - t_1 \right)} \right]$$

where

E_X = calculated energy consumption rate of the appliance at the target temperature t_X,

E_1 = measured energy consumption rate of the appliance for point 1,

E_2 = measured energy consumption rate of the appliance for point 2,

t_1 = measured compartment temperature for point 1 (warm point),

t_2 = measured compartment temperature for point 2 (cold point), and

t_x = -18°C

The value measured in the energy consumption test on the first appliance tested shall not be greater than the energy consumption by more than 10 percent of the rated energy consumption. If the result of the test carried out on the first appliance is greater than the declared value (on marking label) plus 10 percent, the test shall be carried out on a further three appliances. Average energy consumption of three units recorded shall not be more than 10 percent of the value declared by the manufacturer on marking label.

11.3 Temperature Rise Test

The purpose of this test is to check the time for the temperature rise of test packages, after the operation of refrigeration system is interrupted.

The refrigerating appliance shall be prepared in ambient temperature as per climate class mentioned by manufacturer and shall be stabilized and loaded as per **12**.

The setting of temperature control device or other control shall be set to maintain to achieve warmest package temperature of -18^{o}C.

The power supply to the refrigerating appliance shall be cut off immediately after the end of a refrigeration cycle.

For automatic defrosting refrigerating appliances, the power supply shall be cut off after the power disconnection point to be a 'compressor off' during the stable part of the refrigeration cycle. If there are temperature variations, the test shall be commenced at a low temperature point.

The period of time shall be noted from the moment when the temperature of the warmest 'M-package' reaches –18°C to the moment when any one of the 'M-packages' in any of these compartments (or cabinets) first reaches –9°C.

11.4 Door Seal Test

The purpose of this test is to ensure that the gasket of the door of the deep freezer adequately prevents any ingress of the surrounding air. With the freezer at rest, a strip of paper 50 mm wide 0.08 mm thick and of suitable length shall be inserted at any point of the seal and the door closed normally on it shall not slide freely.

11.5 Mechanical Strength of the Shelves and Similar Components

The purpose of this test shall be to check the mechanical strength of the components used for storing food, means shelves, containers, baskets, etc., with the freezer at rest and the door open. The test shall be conducted as follows:

a) Place the shelves in the proper location parallel to a flat surface;

b) Use a height measure, caliper, or ruler to measure the existing deflection (if any) of the shelf at its maximum point on the underside of the shelf;

c) For shelves uniformly load shelf with load of 195.3kg/m^2. Load can be either dead weight or actual products which are uniformly disturbed across the shelf area;

d) After 72 h have elapsed, use the same measuring device used in b) to measure the total deflection of the shelf at its maximum point on the underside of the shelf;

e) Subtract the second measurement from the first measurement to get the total deflection. Divide the total deflection measurement obtained by the width of the shelf to obtain the deflection in cm/m; and

f) Remove the load and measure the total deflection of the empty shelf.

Deflection has to be 1.04 cm/m when loaded with 195.3 kg/m^2. There should be no permanent shelf deformation/deflection which impacts the functionality of component.

However, in the case of baskets, maximum loading shall be checked based on the declaration of instruction manual/product provided by manufacturers.

11.6 Thermal Insulation Test (External Condensation Test)

The purpose of this test is to determine the effectiveness of the insulation, on the external surface of the freezer. The test shall be carried at no load condition.

The freezer shall be held with an average internal temperature of -18°C in a surrounding ambient temperature between 31°C and 33°C and relative humidity between 70 and 75 percent. It shall be considered satisfactory, if condensed moisture is not visible on the outer surface, and no running droplets are visible on the external surface of the freezer during a period of time lasting for 12 h after the test conditions have become stable.

11.7 Pressure Test

All parts of the refrigerating system subject to internal pressure shall be tested. No part of the assembly under test shall show signs of leakage or permanent deterioration after subjecting to the appropriate pressure given in **5.4.**

12 TEST PACKAGES

12.1 Dimension and Mass

When tests are carried out, test packages in the form of right parallelepipeds shall be used. The size and mass of the test packages, including their packaging, shall be as specified in Table 2. The location of test packages and M-packages in frozen compartment shall be as shown in Fig. 11 of Annex D.

The tolerances for new test packages shall be as follows:

a) ± 2 mm for linear dimensions 25 mm to 50 mm;
b) ± 4 mm for linear dimensions 100 mm to 200 mm; and
c) ± 2 percent for mass.

Table 2 Dimensions and Mass of Test Packages

(*Clause* 12.1 **)**

Sl No. (1)	Dimensions mm (2)	Mass g (3)
i)	50 × 100 × 100	500
ii)	50 × 100 × 200	1 000
The following packages may be used as fillers to complete the cabinet loading:		
iii)	25 × 100 × 200	500
iv)	37.5 × 100 × 200	750

Due to the frequency of use and to the loading pressure, the package could change in dimensions and weight. Test packages shall be checked annually for conformity with the following life-time tolerances. When a test package is found to exceed one of the tolerances, it shall be replaced.

a) Loss of mass : -5 percent
b) On the wrapper : No visible hole.
c) Change in linear dimensions :
    1) ± 4 mm for dimensions 25 mm and 50 mm; and
    2) ± 8 mm for dimensions 100 mm and 200 mm.

Each test package shall consist of filling material and a wrapper.

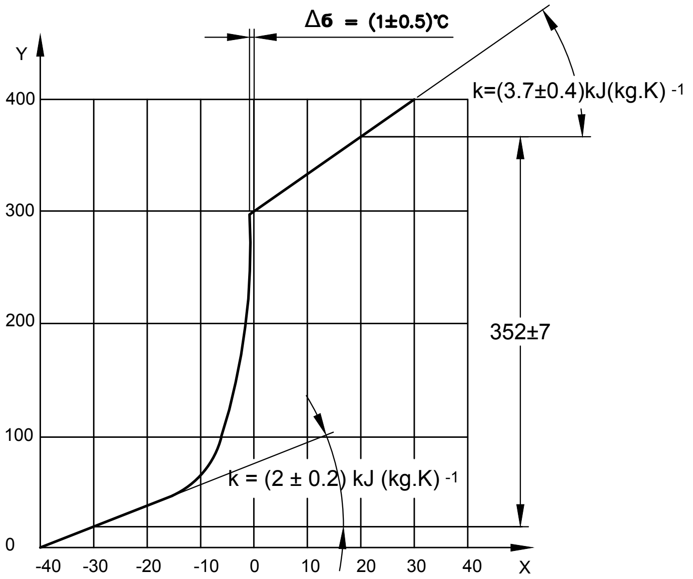
Filling material per 1 000 g shall contain:

1) 230 g of oxyethyl methyl cellulose;
2) 764.2 g of water;
3) 5.0 g of sodium chloride; and
4) 0.8 g of para-chloromethane-cresol.

The freezing point of this material is -1 °C. The enthalpy value of 285 kJ/kg shall correspond to the temperature of (-1 ± 0.5) °C (*see* Fig. 6, Table 3 and Table 4). About 4 percent of water should be added in order to compensate for evaporation during the preparation of the filling material.

12.2 Wrapper

A sheet of plastic or any other suitable material of such nature that exchange of moisture with the



KEY
X Temperature °C
Y Specific enthalpy. kJ/kg

FIG. 6 THERMAL CHARACTERISTICS OF TEST PACKAGES

ambient medium is negligible: the surface emissivity shall be equal to 0.9 ± 0.05 at 25 °C. A laminated sheet should be used, consisting of a layer of high-pressure polyethylene, easily sealed, 120 µm thick, together with an external sheet of polyterephthalate approximately 12.5 µm thick, the two layers being bonded together. After filling, this sheet shall be sealed. The correspondence of the packages material composition with the above mentioned characteristics should be certified by the supplier or by an independent laboratory.

Table 3 Temperature and Specific Enthalpy of Test Packages

(*Clause* 12.1 **)**

Sl No.	Temperature °C	Specific Enthalpy kJ/kg
(1)	(2)	(3)
i)	-40	0
ii)	-30	19
iii)	-25	28
iv)	-20	39
v)	-18	43
vi)	-16	49
vii)	-14	55
viii)	-12	63
ix)	-10	73
x)	-9	79
xi)	-8	85
xii)	-7	93
xiii)	-6	102
xiv)	-5	114
xv)	-4	129
xvi)	-3	152
xvii)	-2	194
xviii)	-1	285
xix)	0	297
xx)	+10	334
xxi)	+20	371

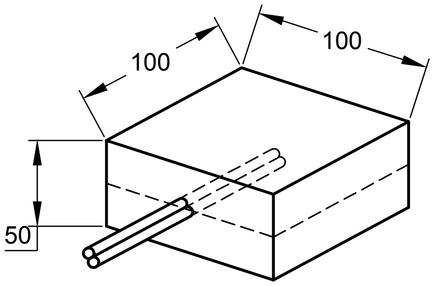
Table 4 Temperature and Increase in Specific Enthalpy of Test Packages

(*Clause* 12.1 **)**

Sl No.	Temperature Range °C	Increase in Specific Enthalpy kJ/kg
(1)	(2)	(3)
i)	-30 to -20	20 ± 2
ii)	+10 to +20	37 ± 4
iii)	-30 to +20	352 ± 7

12.3 M-Packages Life-Time

Some of the 500 g packages (50 mm × 100 mm× 100 mm) shall be equipped for temperature measurement, being fitted with temperature sensors inserted in the geometrical center of the packages in direct contact with the filling material. All precautions shall be taken to minimize extraneous conduction of heat and to avoid any possibility of entrance of the air from the hole in the wrapper for the passage of the temperature sensor that could create oxidation and loss of weight in the filling material. These packages are called M-packages (*see* Fig.7). Due to frequency of use and loading pressure the package could change in dimensions and weight. All M-packages shall be checked annually for conformity with the life time tolerances specified in **12.1**. The checking results shall be recorded for each lot of M-packages. When a M-package is found to exceed one of the tolerances, it shall be replaced.



All dimensions in millimetres.

Fig. 7 M-Package

13 MARKING AND INSTRUCTION

13.1 Marking on Freezer

Each deep freezer shall have the following information marked in a permanent and legible manner on one or several locations where it is readily accessible.

a) Manufacturer’s name and the trade-mark;
b) Model (or commercial designation) of freezer and Sl No.;
c) Rated gross volume, in litres;
d) Rated storage volume;
e) Name of the refrigerant used in system and its quantity;
f) Full load current or rated current or rated power input;
g) Type of freezer;
h) Rated voltage or voltage range;
j) Rated frequency of supply; and
k) Country of manufacture.

13.1.1 Each freezer shall be accompanied on delivery by instructions for its use and maintenance printed on strong paper, cardboard or similar material. These instructions shall at least provide following information relating to:

a) Installation requirements;
b) Conditions of operation (starting, stopping);
c) Use of various control devices (thermostat, defrosting, etc); and
d) Maintenance and cleaning the freezer.

13.2 BIS Certification Marking

The product conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act,* 2016 and the Rules and Regulations framed there under, and the product may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

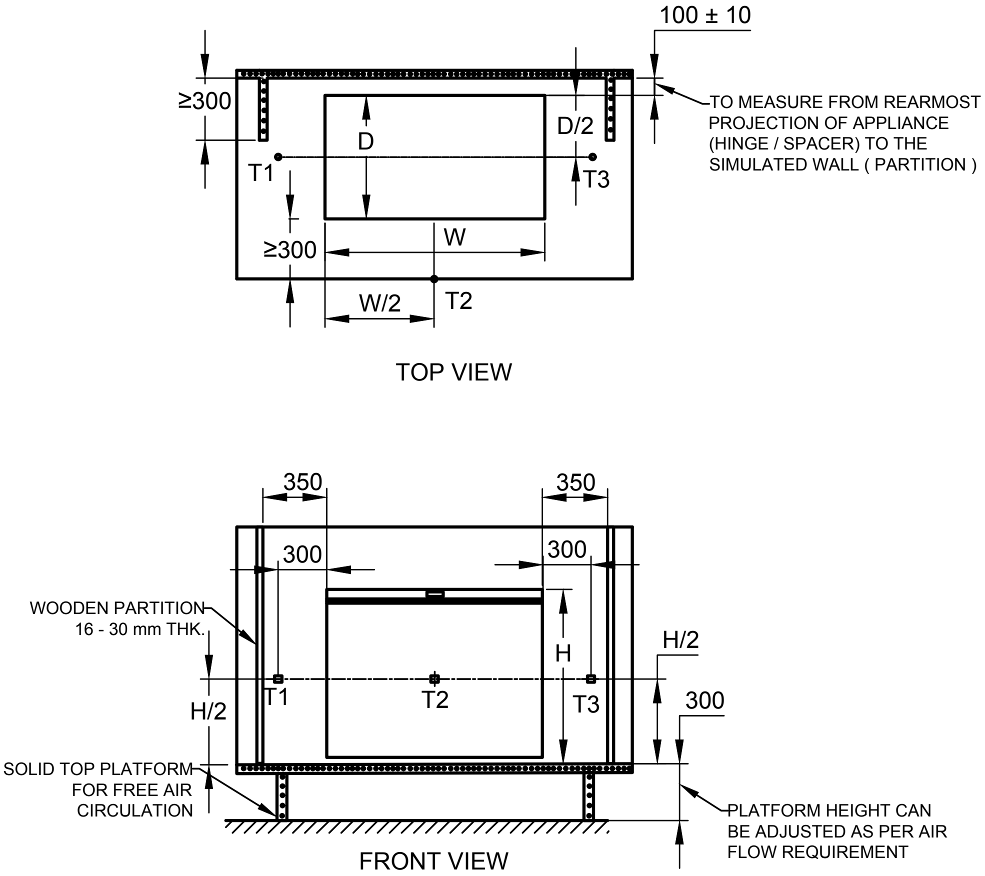
LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
9000 (Part 11) : 1983	Basic environmental testing procedures for electronic and electrical items: Part 11 Salt mist test
10617 : 2018	Hermetic compressors — Specification
15750 : 2006	Household frost-free refrigerating appliances — Refrigerators cooled by internal forced air circulation — Characteristics and test methods
16678 (Part 2) : 2018/ ISO 5149-2 : 2014	Refrigerating systems and heat pumps — Safety and environmental requirements: Part 2 Design, Construction , Testing, Marking and Documentation
IS/IEC 60335-2-89 : 2010	Safety of household and similar electrical appliances: Part 2 Particular requirements Section 89 Particular requirements, for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor

ANNEX B

(*Clause* 3.2)

AMBIENT TEMPERATURE MEASUREMENT


100 ± 10
≥300
D
D/2
T1
T3
TO MEASURE FROM REARMOST PROJECTION OF APPLIANCE (HINGE / SPACER) TO THE SIMULATED WALL (PARTITION)
≥300
W
W/2
T2
TOP VIEW
350
350
300
300
WOODEN PARTITION 16 - 30 mm THK.
H
H/2
T1
T2
T3
H/2
300
SOLID TOP PLATFORM FOR FREE AIR CIRCULATION
PLATFORM HEIGHT CAN BE ADJUSTED AS PER AIR FLOW REQUIREMENT
FRONT VIEW

NOTE 1:

T1,T2,T3 AMBIENT MEASURMENT SENSOR'S LOCATION
UNSPECIFIED TOLERANCE ON DIMENSIONS ARE +/- 50 mm

NOTE 2:

AMBIENT SENSOR SHALL BE SHIELDED FROM ANY SOURCE OR SINK OF RADIANT HEAT WHICH INFLUENCE MEASUREMENT AIR TEMPERATURE,INCLUDING CONDITIONING EQUIPMENT, EXTERNAL DOORS, OR APPLIANCE UNDER TEST

All dimensions are in millimetres

FIG. 8 MEASUREMENT OF AMBIENT TEMPERATURE

ANNEX C

(*Clauses* 3.4, 8.1, 8.3 *and* 11.1)

THERMOCOUPLE LOCATION FOR TEMPERATURE MEASUREMENT

THERMOCOUPLE LOCATION FOR TEMPERATURE MEASURMENT
-ICELAND HARD TOP/GLASS TOP FREEZERS

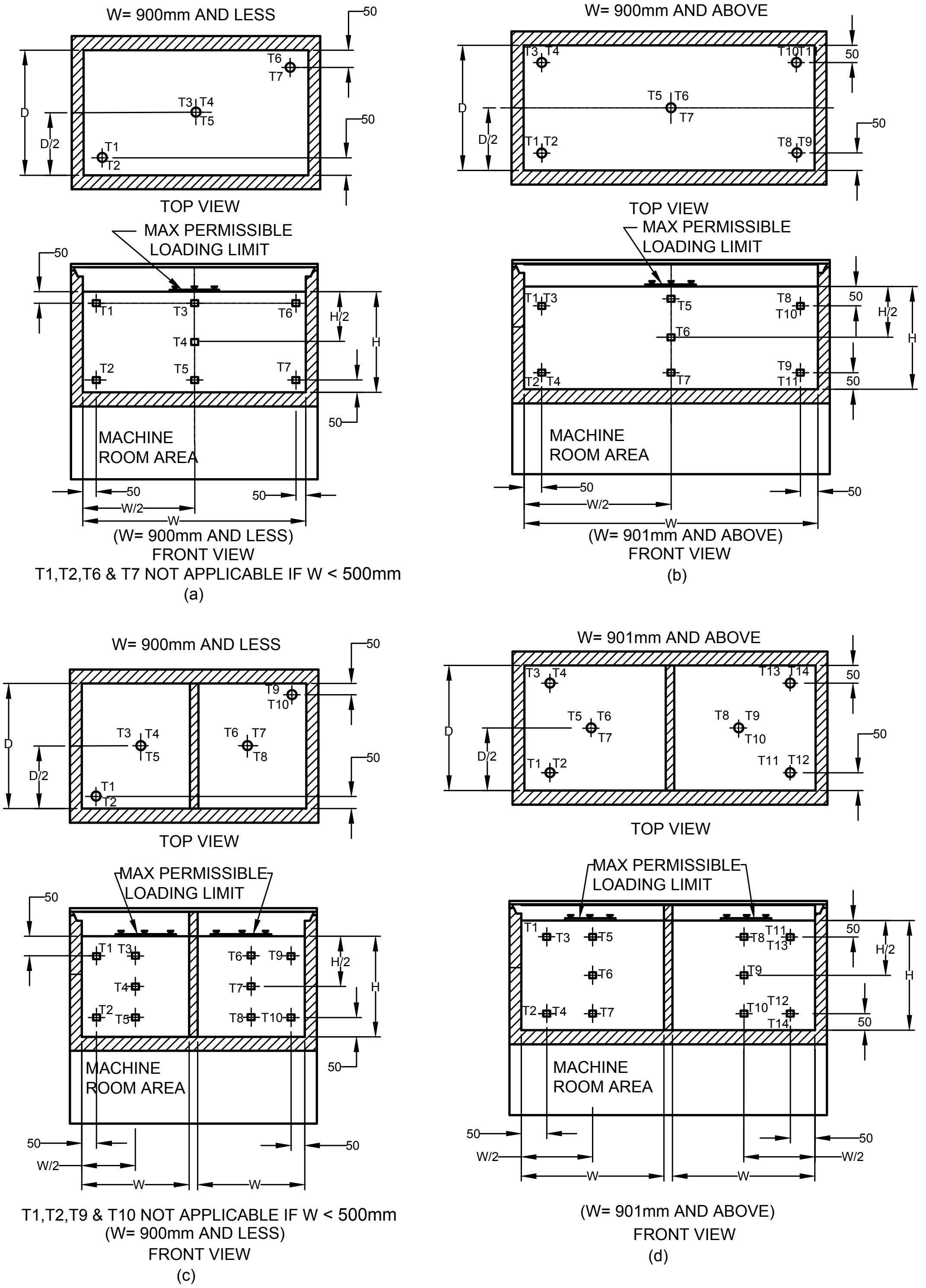
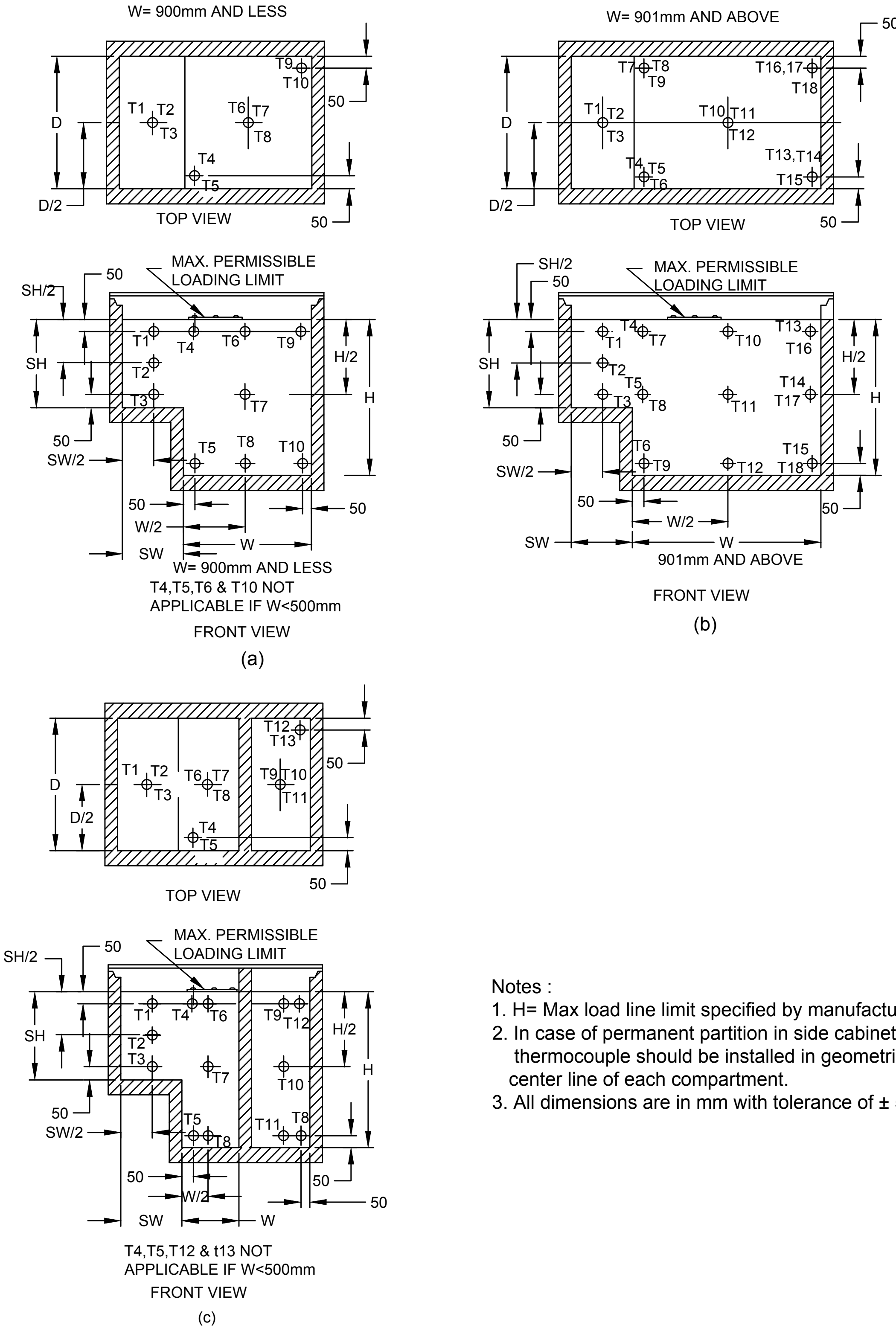


Fig. 9 Location for Thermocouples for Temperature Measurement

ANNEX C (*Concluded*)

(*Clauses* 3.4 *and* 8.3)

THERMOCOUPLE LOCATION FOR TEMPERATURE MEASUREMENT HARD TOP/FLAT GLASS TOP/CURVED GLASS TOP FREEZERS



Notes :

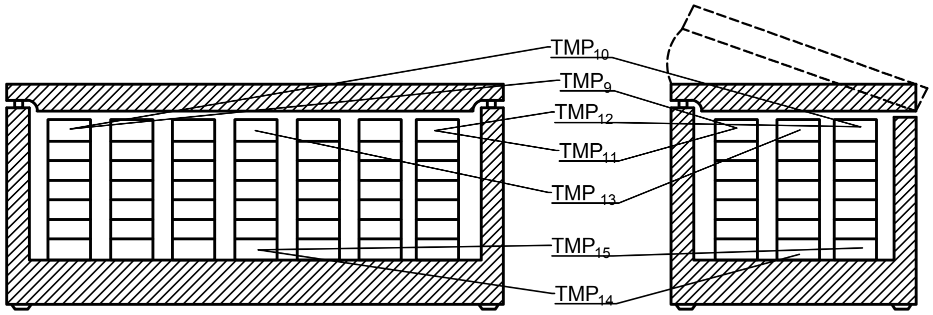
1. H= Max load line limit specified by manufacturer.
2. In case of permanent partition in side cabinet then thermocouple should be installed in geometrical vertical center line of each compartment.
3. All dimensions are in mm with tolerance of ± 5.

FIG. 10 THERMOCOUPLE LOCATIONS FOR TEMPERATURE MEASUREMENT

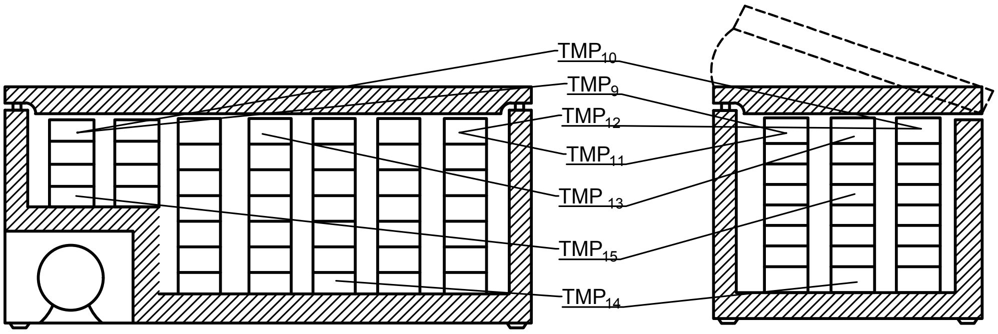
ANNEX D

(*Clause* 12.1)

LOCATION OF TEST PACKAGES AND M-PACKAGES IN FROZEN COMPARTMENT



a) CHEST FREEZER



b) CHEST FREEZER (STEPPED LINER)

CHEST FREEZERS AND OTHER TOP OPENING COMPARTMENTS

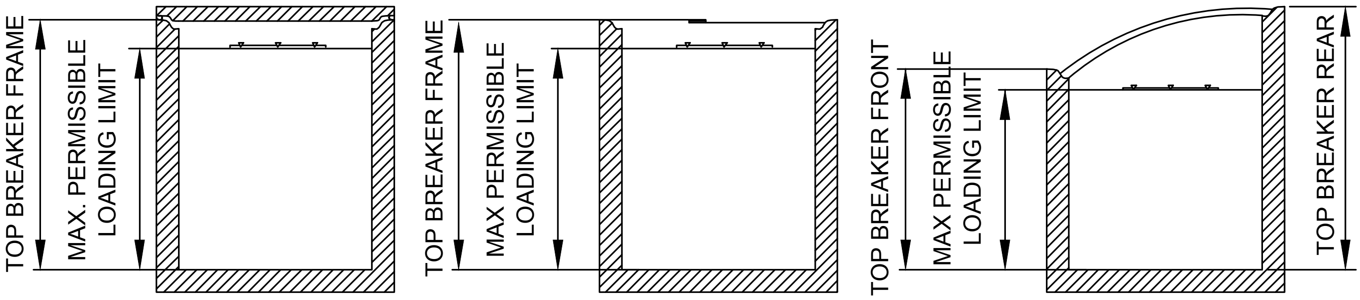
TMP_{9} = TOP LEFT FRONT M-PACKAGE
TMP_{10} = TOP LEFT BACK M-PACKAGE
TMP_{11} = TOP RIGHT FRONT M-PACKAGE
TMP_{12} = TOP RIGHT BACK M-PACKAGE
TMP_{13} = CENTRE TOP
TMP_{14} = CENTRE BOTTOM
TMP_{15} = ABOVE THE COMPRESSOR OR BOTTOM CORNER OR AND LIKELY TO BE WARMEST

FIG. 11 LOCATION OF TEST PACKAGES AND M-PACKAGES ON FROZEN COMPARTMENT

ANNEX E

(*Clause* 8.3)

MAXIMUM STORAGE LIMIT LINE


TOP BREAKER FRAME
MAX. PERMISSIBLE LOADING LIMIT
TOP BREAKER FRAME
MAX PERMISSIBLE LOADING LIMIT
TOP BREAKER FRONT
MAX PERMISSIBLE LOADING LIMIT
TOP BREAKER REAR

HARD TOP FREEZER GLASS TOP FREEZER CURVED GLASS FREEZER

LOAD LIMIT LINE SPECIFICATION

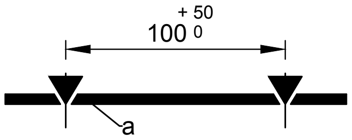


FIG. A CONTINUOUS LOAD LIMIT LINE

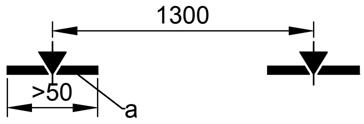
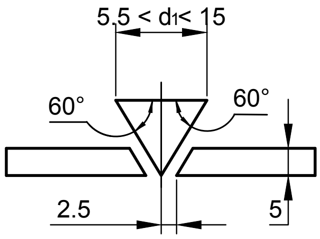


FIG. B LOAD LIMIT LINE REPEATED AT INTERVALS



key

a) This denotes the load limit,

All dimensions in millimeters

FIG. C DIMENSIONS OF LOAD LIMIT LINE

The load limit line shall be continuous (see figure A), or repeated at intervals (figure B), to ensure that it can not be overlooked. Individual markings shall be at least 50mm long and shall contain at least one equilater triangle with side dimension, d_1 , included with in 5.5mm and 15mm(see figure C)

FIG. 12 MAXIMUM STORAGE LIMIT LINE

ANNEX F

(*Foreword*)

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Panel on Specification of Deep Freezers

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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